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Analysing the Effects of Human Resource Allocation and Learning by Experience on Project Management in Defence Industry

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ABSTRACT

Activities that started using various resources and carried out to produce a product or service in a limited time are called projects. Process of delivering the project to an end with plans made to achieve project's goals in desired extent and time is called project management. Successful project management is becoming more important for competing companies. The project manager, who is responsible for execution of one or more projects, gains a lot of experience throughout the process and becomes more knowledgeable and skilled. The main purpose of this study is to reveal the effects of learning with experience and human resources allocation on multi-project management. Survey which is prepared to evaluate the sub-goals under the main purpose is applied online to the project managers who are working in institutions operating in defence industry in Ankara. Data obtained via the survey are analysed by a statistical software. As a result, it's found that the current knowledge of employees and their experience have a positive effect on managing projects. It's been evaluated that there may be disruptions in customer relations and project management when human resource planning is insufficient and it's important to consider the experience of employees to make allocations.

Keywords: Multi project management, Human resource allocation, Experience, Learning curves

INTRODUCTION

All of the activities that are started to complete a concrete product or service in a certain period and that require certain resources to be completed are called projects. Making a project about a product or service and advancing in the process to bring the project to the end by complying with these plans is called project management.

The effect of learning is inevitable in the project management process, as in all processes. It is known that the time required to complete a job gets shorter as the person working on that job gains relevant experience. However, since unnecessary work will be minimized, it can be said that learning will increase productivity by reducing the excess resources spent. When it comes to the basis of the learning activity, it can be seen that the big effect is actually from repetition. When a person repeats the work he is working on without

interruption, he gains experience in that work and becomes able to do the work faster.

There may be differences between employees in many areas. Not everyone can make the same degree of progress in learning simultaneously. It can be said that performance measurements and analyses to be made while gaining experience in a job will be beneficial in measuring the learning process correctly. In addition, these analyses can also be used in the selection of jobs that are suitable for the personality traits and skills of the employees to best assign human resources to the current jobs. As a result of the analysis and evaluation, by making person-based job assignments according to the learning speed of the people and in which areas they are more productive, an increase in the productivity of both the people and the work they are working on can be revealed.

In this study, the human resources problem that arises in companies working in the field of project management in the defense industry and in units that simultaneously manage more than one project has been examined in depth. In this way, it is aimed to investigate the positive and negative effects of time-based learning and person-based experiences gained in the field of study on project management processes. Some related studies in the literature are (Belout 1998; Chen 1983; Plaza et al., 2011; Plaza et al., 2010; Fung 2015; Ojiako et al., 2011).

The main purpose of the study is to reveal the human resource allocation problem in multi-project management and the effect of experience and learning on project management. Since there is more than one sub-objective under the main objective, it is possible to evaluate the findings of the study from different perspectives. It is important from different aspects that the allocation of human resources, which is the subject of this research, and the effect of experience and learning on the project management process are examined through a survey study.

One of these aspects is that the correct allocation of human resources is a very important issue in terms of project management and there is a lot of research on this subject in the literature. However, because each study's universe, sample, and method of application differ, the effect of human resource allocation and its magnitude vary across studies. A survey conducted among project managers working in defense industry companies reveals the impact of human resources in the management process of defense industry projects. It will guide the managers in solving the problems experienced due to the lack of human resources in the companies where the people who fill out the survey work. And the second, the effect of learning by experience has been examined in most studies in the literature on people working in the construction and manufacturing sectors, and the evaluation of the results is revealed by analyzing time-dependent measurements. In the project management process, there is less continuous and repetitive work compared to the manufacturing or construction sectors. It is more difficult to analyze the productivity increase due to experience in the jobs created as a result of experience.

Considering all these, this study, in which the effect of experience is observed, will reveal how productivity changes when experienced people work in project management processes and will contribute to the improvement of processes.

In the following Method section, the research model, the characteristics of sample and how the sample is determined, are mentioned; the survey study is explained and the data collection method and the method are explained in detail. In the Findings and Discussion section, the findings and statistical analyzes that emerged as a result of the survey are presented, and the relationship between the obtained data and the hypotheses are presented. Finally, in the Conclusion part, the comments and inferences presented in the previous part are summarized, the extent to which the results meet the expectations is explained based on the hypotheses, the common points of the result of the study with other studies in the literature are stated, and suggestions for future studies are presented.

METHOD

The research is both a descriptive cross-sectional and an analytical quantitative field study designed to test hypotheses. The main purpose is to address the human resource allocation problem in multi-project management and to reveal the effect of experience and learning on project management. The demographic characteristics of the project managers participating in the survey and the characteristics of their project management are independent variables. The dependent variables are the answers given to the questions prepared to reveal the human resource allocation problem and the effect of experience and learning on project management. The responses of each demographic and dependent variable are analyzed descriptively, and the distributions are given. In the analytical part of the study, the relationship between independent and dependent variables is examined by hypothesis tests. In the study, there are 6 questions in total as demographic characteristics and 8 questions in total as project manager characteristics. The study has a total of 21 questions related to the project management environment and human resources constraints. These 21 questions are grouped under 5 factors. These factors are "The impact of effective job-employee assignments on project management", "The effect of the adequacy of the number of employees on the project management", "The effect of business planning on project management", "The effect of gained experience on project management" and "Effect of learning on project management". Hypothesis tests are used to evaluate whether the answers to these 5 factors (consisting of questions about the current knowledge level of the project manager, in-house training and the learning status of the employee) differ significantly according to the demographic characteristics of the participants and the characteristics of the project manager. The hypotheses are established according to the factor structures determined by factor analysis.

Limitations of the Study

One of the limitations is that the research is conducted in companies operating in the defense industry. It has been anticipated by the researcher that there may be limitations in the answers given to the questions due to information security in the defense industry sector. To prevent this situation, the participants were informed that their personal information was not collected

and that the information would only be used for scientific purposes. Although the face-to-face interview method was envisaged at the beginning of the research, the study data were obtained by online survey application since it was not possible to apply this method during the COVID-19 pandemic. This harmed the data collection process, and fewer responses were received from the participants. In addition, while focus group interviews and face-to-face interview methods could be applied in the study, it could not be carried out due to the current pandemic, and in-depth interviews could not be conducted with experienced project coordinators. Due to the online application of the surveys, fewer open-ended questions are included, and there is a time limit. The results of the study can only be generalized to the project managers at the institutions in the population of research.

Population and Sample of the Research

The study's population consists of project managers and engineers with project management experience from four companies in Ankara that operate under the presidency of Defense Industries. The sample size of the study is determined to have a 95% confidence level, the power of the study to be 80% (a large effect size), and a minimum of 90. Since there are also questions examining job performance based on experience in the survey, no minimum work experience or age criteria are taken into account while determining the sample. Within the determined sample size, 122 people are included in the study. Within the framework of the sample, gender, age, and professional experience are taken into account. For the preliminary evaluation of the questions in the survey, a pilot study was made to a number of people (50 individuals), approximately twice the number of questions (21 questions). Persons with project management experience, who would reflect the sampling frame, are included in the pilot study. Pilot data are included in the main study to avoid revision. The study was conducted with people with project management experience who agreed to participate. The participants of the study are people who can understand the relevance of the research questions to the research topic and answer the questions impartially using their own experiences.

Data Collection and Evaluation

The data collection tool of the study is a survey, and the survey prepared by the researcher is applied to the participants online. The questions in the survey are sent to each person as a personalized link via their e-mail addresses, thus preventing any bias in the results. A total of 36 questions are included in the survey study, which is prepared and applied within the scope of the study. There are open-ended and closed-ended questions, multiple choice questions, rating questions, and demographic questions, depending on the type of answer desired to be obtained from the question. The questions are determined in order to test the hypotheses created based on the assumptions put forward in the studies in the literature. The survey consists of two parts. In the first part of the survey, participants' age, gender, educational background, areas of expertise, and individual characteristics of the project manager are questioned. In this context, the total working hours of the participants in the

sector, their working time in the current company, their working time as a project manager, their status as the sole authority in the project, their simultaneous dealing with more than one project, the number of people they work with in the project, etc. variables are taken into account. The questions in the last part of the survey are prepared in such a way as to determine the problems faced by the project managers, to evaluate the current situation, to collect positive and negative opinions about the project management process, to determine the current knowledge level of the project managers, to investigate the effects of the experience and training they received, and to contribute to the shaping of the suggestions to be made. In this section, questions about the project management environment and human resource constraints, the current knowledge level of the project manager, in-company trainings, and the learning status of the employee are included. Explanatory factor analysis is used to categorize the items in this section of the survey into five factors. The completion time of the survey is approximately 10 minutes.

Reliability and Validity Analysis

Before the pilot study, reliability analyses of the questions related to the project management environment and human resources constraints, the current knowledge level of the project manager, in-company pieces of training, and the learning status of the employee in the survey are conducted. A reliability analysis is carried out for a total of 21 Likert scaled questions. A Cronbach Alpha value of 0.88 is obtained. All questions remained in the survey, and no question is required to be deleted. For this reason, the data obtained as a result of the pilot study is also used in the main study.

Explanatory factor analysis and confirmatory factor analysis methods are used in the validity analysis. Explanatory Factor Analysis (IBM SPSS 25) is used to test which groups of variables are highly correlated with which factor. Confirmatory Factor Analysis (AMOS 21) is used to see if the variable groups that contributed to the determined k number of factors are adequately represented by these factors.

Research Hypothesis

In this study two main hypotheses are improved: H1->There is a significant difference between the answers given to the factors according to the demographic characteristics of the survey participants. H2->There is a significant difference between the answers given to the factors according to the project manager characteristics of the survey participants.

10 sub-hypotheses are created under the main hypotheses: H11->"The effect of effective job-employee assignments on project management" dimension differs significantly according to the demographic characteristics of the respondents. H12->Responses to the dimension "Effect of employee adequacy on project management" differ significantly according to the demographic characteristics of the respondents. H13->"The effect of business planning on project management" dimension differs significantly according to the demographic characteristics of the respondents. H14->"The effect of

the experiences gained on the project management" dimension differs significantly according to the demographic characteristics of the respondents. H15->"The effect of learning on project management" dimension differs significantly according to the demographic characteristics of the respondents. H21->"The effect of efficient job-employee assignments on project management" dimension average differs significantly according to the project manager characteristics of the respondents. H22->"The effect of the adequacy of the number of employees on the project management" dimension differs significantly according to the project manager characteristics of the respondents. H23->"The impact of business planning on project management" dimension responses differ significantly according to the project manager characteristics of the respondents. H24->"The effect of the experience gained on the project management" dimension differs significantly according to the project manager characteristics of the respondents. H25->"The effect of learning on project management" dimension differs significantly according to the project manager characteristics of the respondents.

FINDINGS AND DISCUSSION

The findings are analyzed in three parts. First, descriptive statistics are found according to the demographic and managerial characteristics of the respondents. Some of the results are given in the Tables 1–10.

Secondly, the results obtained from the answers of the participants to the questions about the project management environment and human resources constraints, the current knowledge level of the project manager, in-company trainings, and the learning status of the employee are summarized below.

Table 1. Distribution of respondents by gender.

Gender	Frequency (n)	Percentage (%)
Male	49	40.8
Female	71	59.2

Table 2. Distribution of respondents by age groups.

Age range	Frequency (n)	Percentage (%)
34 years and less	73	59.8
35–59 years	36	29.5
60 years and more	13	10.7

Table 3. Distribution of respondents according to their educational background.

Educational status	Frequency (n)	Percentage (%)
B.A.	46	37.7
M.Sc.	68	55.7
Ph.D.	8	6.6

Table 4. Distribution of respondents according to their fields of expertise.

Province	Frequency (n)	Percentage (%)
Electrical electronics engineer	50	41.0
Mechanical engineer	22	18.0
Industrial engineer	29	23.8
The others	21	17.2

Table 5. Distribution of respondents according to their working hours.

Working time	Frequency (n)	Percentage (%)
5 years and less	27	22.1
6–10 years	18	14.8
11–15 years	22	18.0
15 years and more	55	45.1

Table 6. Distribution of respondents according to working hours at their current workplace.

Working time at current workplace	Frequency (n)	Percentage (%)
5 years and less	49	40.2
6–10 years	22	18.0
11–15 years	14	11.5
15 years and more	37	30.3

Table 7. Distribution of respondents according to their working hours as project managers.

Working time as a project manager	Frequency (n)	Percentage (%)
5 years and less	64	52.5
6–10 years	27	22.1
11–15 years	17	13.9
15 years and more	14	11.5

81.2% of the project managers who participated in the survey stated that the current load of the employees is not taken into account when assigning work-employee assignments. In addition, 68.8% of the participants stated that the distribution of work is not fair. Project managers have a rate of 68.9% who say that productivity will increase when there are personnel proportional to the number and load of the project. A group of 83.6%, who experienced lack of time in the project and related disruptions in the process, stated that their attention and productivity decreased when their work is divided due to another job. According to the duration of work as a project manager, 50% of

Table 8. Distribution of the survey participants' simultaneous involvement in other projects.

How many projects are you simultaneously dealing with in your current position?	Frequency (n)	Percentage (%)
1 project	18	14.8
2 projects	30	24.6
3 projects	24	19.7
4 or more projects	50	41.0

Table 9. Distribution of total overtime hours in a week.

Working hours	Frequency (n)	Percentage (%)
1-2 hours	16	13.1
3–4 hours	29	23.8
5–6 hours	27	22.1
6+	25	20.5
Never	25	20.5

Table 10. Distribution of answers to the question, "How long do you think it takes to manage the project fully?".

Duration	Frequency (n)	Percentage (%)
1-2 years	25	20.5
3–4 years	37	30.3
5+ years	29	23.8
Not yet	31	25.4

the respondents agree with the statement "There is a disruption in the project management process due to the lack of time of the project manager," while the rate of those who are undecided is 30.3%. 93.46% of the survey participants, regardless of age, stated that when they do repetitive tasks, they get better at that job and do it more easily. On the other hand, while 96.8% of the participants stated that the positive and negative experiences in the project management process will affect the decisions to be taken in the future, 95.1% of the participants stated that they would be better managers when they considered the positive and negative experiences, regardless of their educational status. As a result, it is possible to state that the existing knowledge levels and experiences of the employees have a positive effect on the project management process. Finally, results are given for each of the two main hypotheses, which are only statistically significant. Age, gender, education, specialization areas, and the characteristics of the project manager are examined in the demographic characteristics of the respondents. The non-parametric Mann-Whitney U test (which controlling the difference between two independent groups) is used to determine whether the factor averages of the survey differed significantly according to demographic characteristics. Compliance of the data with a normal distribution is determined by the Kolmogorov-Smirnov

test and it is observed that it did not show compliance with a normal distribution ($p<0.05$). The Kruskal-Wallis test is used to test the means of more than two groups, and the Levene test is used for the homogeneity of variances. Bonferonni test (one of the PostHoc tests) is used to determine the groups that created the difference in the variables with significant differences.

Summary related with H1->There is a significant difference between the answers given to the factors according to the demographic characteristics of the respondents. A significant difference is determined between the factor averages according to age groups in the factors of "Effect of effective job-employee assignments on project management," "Effect of experience gained on project management," and "Effect of learning on project management" ($p = 0.003$, $p = 0.005$, p). $=0.038$). It is determined that the difference in the factor "Effects of effective job-employee assignments on project management" is due to the difference between the 20–34 age group and the 35–59 age group ($p = 0.001<0.0167$). While the factor average of "Effects of effective job-employee assignments on project management" is 2.80 for the 20–34 age group of project managers, it is 3.32 for the 35–59 age group. In the factor "Effect of experience gained on project management," it is determined that the difference according to age is caused by the difference between the 35–59 age group and the 60–74 age group ($p = 0.015<0.0167$). While the factor average for the 35–59 age group is 4.78, the average for the 60–74 age group is 3.70. In determining the significant difference between the factor averages according to their educational status, a significant difference is determined in the factor "The effect of the experiences gained on the project management" ($p = 0.012$). It is determined that the difference stems from the project managers' undergraduate and graduate levels. While the average of project managers with a bachelor's degree is 4.46, the average of project managers with a master's degree is 4.81. Significant differences are found in the factor "The effect of learning on project management" according to the fields of specialization ($p = 0.002$). For instance, the difference arises from the difference between electrical-electronic engineers and industrial engineers. The average for electrical and electronic engineers is 3.35, and the average for industrial engineers is 2.42.

Summary related with H2->There is a significant difference between the answers given to the factors according to the characteristics of the project manager. There is a significant difference in the factor "The effect of learning on project management" according to the total working time ($p = 0.04$). The difference is due to those with less than 5 years of employment and those with 11–15 years of employment ($p = 0.012<0.0167$). The average of the factor "Effect of learning on project management" for those who have been working for less than 5 years is 3.09, and the average for those who have been working for 11–15 years is 3.33. A significant difference is found in the factor of "The effect of the adequacy of the number of employees on the project management" according to the working hours in the current company ($p = 0.046$). The difference is due to the difference between those who work in the company for 6–10 years and those who work for 11–15 years ($p = 0.013<0.0167$). A significant difference is found in the factor "Effects of effective job-employee assignments on project management" according to

working hours as a project engineer ($p = 0.018$). The difference is due to the difference between those who worked 11–15 years and those who worked as project engineers for more than 15 years ($p = 0.007<0.008$). While the average is 3.54 for project engineers between 11–15 years, it is 2.52 for those who work more than 15 years.

CONCLUSION

Within the scope of the study, when the questions asked based on age are evaluated in order to determine the existing problems, it can be interpreted from the answers given by the young participants that they are more critical and open to innovations against the current order. The project managers who participated in the survey experienced some disruptions in the project management processes in the companies they work for, and the main source of these are: 1) lack of human resources, 2) making unbalanced job assignments, 3) the current level of knowledge is insufficient to carry out the processes successfully, 4) lack of a mentor that employees who do not feel competent in their field of work can consult, 5) not supporting employee development activities with necessary trainings. As a result of this work, project managers have opportunities such as; observing the current situation among the four companies participating in the survey, to be able to notice the problems experienced by the employees more easily and to take preventive action, to determine the deficiencies in the processes and the problems caused/may be caused by these deficiencies, and to be able to work in these areas, measure the contribution of the employee's current knowledge, experience, and training to the project management process. In summary, with this study, awareness is created among the senior management staff of the enterprises. In the literature, since most of the studies working under human resource constraints and investigating the effect of experience and learning on the process are not conducted in the field of project management, alternative subjects can be focused on in future studies by using different variables in this area. In addition, if the survey within the scope of this study, is filled with the participation of multiple sector employees instead of project managers operating in the defense industry; regardless of the sector, the problems experienced in the project management processes and how these problems can be solved can be determined. In this way, the effects of experience and human resource constraints on project management processes can be generalized.

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